U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF MICROSCOPY.

FOOD PRODUCTS.—I.

TWELVE EDIBLE MUSHROOMS OF THE UNITED STATES,

WITH

DIRECTIONS FOR THEIR IDENTIFICATION AND THEIR PREPARATION AS FOOD.

BY

THOMAS TAYLOR, M. D.,

CHIEF OF THE DIVISION OF MICROSCOPY.

REVISED AND REPRINTED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE, WITH AN APPENDIX.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

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INTRODUCTORY NOTE.

U. S. Department of Agriculture,
Division of Microscopy,
Washington, D. C., December 1, 1892.

Sir: The continued requests received in this division for information relating to edible mushrooms and their culture render desirable the reprint of that portion of my report for 1885 which treats of this subject. The article in question, which has been carefully revised, together with an appendix on the Preparation of Mushroom beds, is therefore respectfully submitted for republication.

Very respectfully,

Thomas Taylor,
Microscopist.

Hon. J. M. Rusk,
Secretary of Agriculture.

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TWELVE EDIBLE MUSHROOMS OF THE UNITED STATES.

For several years past the Division of Microscopy of the U. S. Department of Agriculture has been in receipt of numerous letters from regular correspondents and others to the effect that in various localities, representing almost every section and climate of the Union, there are found large quantities of edible mushrooms and other allied fungi, few of which are utilized because the great majority of the people do not know how to distinguish the edible from the poisonous species. To obtain some clear and trustworthy criteria by which to make this essential distinction has been the object of the various communications received, and, in view of the highly nutritious properties of this class of esculents and of the great possible value of their aggregate product, as indicated by the vast quantities produced in countries where attention is given to their cultivation, the importance of a satisfactory answer to these inquiries will be readily appreciated.

FOOD VALUE OF MUSHROOMS.

Rollrausch and Siegel, who claim to have made exhaustive investigations into the food values of mushrooms, state that "many species deserve to be placed beside meat as sources of nitrogenous nutriment," and their analysis, if correct, fully bears out the statement. They find in 100 parts of dried *Morchella esculenta* 35.18 per cent of protein; in *Helvella esculenta*, 26.31 per cent of protein, from 46 to 49 per cent of potassium salts and phosphoric acid, 2.3 per cent of fatty matter, and a considerable quantity of sugar. The *Boletus edulis* they represent as containing in 100 parts of the dried substance 22.82 per cent of protein. The nitrogenous values of different foods as compared with the mushroom are stated as follows: "Protein substances calculated for 100 parts of bread, 8.03; of oatmeal, 9.74; of barley bread, 6.39; of leguminous fruits, 27.05; of potatoes, 4.85; of mushrooms, 33.0." A much larger proportion of the various kinds of mushrooms are edible than is generally supposed, but a prejudice has grown up concerning them in this country which it will take some time to eradicate. Notwithstanding the occurrence of occasional fatal accidents through the inadvertent eating of poisonous species, fungi are largely consumed both by savage and civilized man in all parts of the world, and while they contribute so considerable a portion of the food product of the world we

may be sure their value will not be permanently overlooked in the United States, especially when we consider our large accessions of population from countries in which the mushroom is a familiar and much prized edible.

In France mushrooms form a very large article of consumption and are widely cultivated. Mushroom beds are cultivated in caves, frequently miles in extent. A cave at Mery is mentioned as containing, in 1867, 21 miles of beds, and producing not less than 3,000 pounds daily. Another at Frepillon contains 16 miles of beds. The catacombs and quarries of Paris and vicinity, and the caves of Moulin de la Roche, Sous Bicetre, and Bagneux produce immense quantities of mushrooms. They are all under Government supervision, and are regularly inspected like the mines.

The mushroom which is cultivated in these quarries and caves almost to the exclusion of all others is the "Snow Ball" (*Agaricus arvensis*). The truffle is held in high esteem and is largely exported. In 1872 the quantity of truffles exported from France was valued at over 3,000,000 francs. In 1879 at nearly 10,000,000 francs. Immense quantities of the *Agaricus deliciosus* are sold in the Marseilles markets. The *Fistulina hepatica* is also in great demand, and many other varieties appear from time to time in the markets throughout France. The natives of Australia use largely a truffle which attains a weight of more than 2 pounds, and is known under the name of "native bread." The Chinese, who are noted for the care bestowed on their esculent vegetation, consume large quantities of edible fungi, importing largely from Japan and Tahiti. The trade in edible fungi from Tahiti to China commenced about the year 1866; in 1868 only 70 tons were shipped; in 1873 135 tons were exported to China, and in 1874 152 tons were exported.

The value of mushrooms imported by Shanghai from Tahiti in 1872 was 107,000 taels, and in 1873 138,800 taels—the tael is worth about 6 shillings sterling, or about $1.50 in United States currency. The fungus shipped (*Hirneola auricula-Judæ* B.) is said to be very rich in fungine and nitrogen. It is a very bulky freight; 10 tons will occupy the room of 30 tons ordinary freight.

A very laudable practice of the Chinese Government alluded to in an English journal, and which might perhaps be advantageously adopted in this country, is the publishing for annual gratuitous distribution of numerous treatises, describing the different herbs which can be utilized in whole or in part for food purposes. One of these treatises is called the "Anti-Famine Herbal," and consists of six volumes, containing descriptions, with illustrations, of over four hundred plants which can be used as food. These volumes are of inestimable value in districts where the ravages of insects, drought, etc., have destroyed the grain and rice crops, and famine is imminent. For some years past New Zealand has exported large quantities of an edible fungus to San Franciso and Hongkong for use of the Celestials. A full account of this

industry may be obtained from the United States consular reports. The gathering and drying of the fungus gives profitable employment to large numbers of colonial children, as well as to the Maoris. The species grows abundantly in the wooded regions of New Zealand, and when dry is worth from 4 to 5 pence a pound. The Chinese, who are singularly free from prejudice in the matter of food, use it, as they do the edible nest of their swallow, as a chief ingredient in their favorite soup. They also employ it as a medicine, and, stranger still, for making a valuable dye for silk. Another remarkable edible fungus of New Zealand is the *Sphæria Robertsii*, which grows out of the body of a large caterpillar, practically converting the latter into vegetable substance. The caterpillar lives under ground, and the fungus springs upward through the soil till it reaches a height of 8 or 10 inches. It is eaten by the Maoris, who employ it also, when burned, as a coloring matter.

The Japanese grow several species of edible fungi in logs of decaying wood in a manner peculiar to themselves, and, aside from the home consumption, they in one year exported to China mushrooms to the value of $60,000. In 1879 mushrooms were exported from Japan to the value of 243,440 yens. The yen is equal to 99.7 cents. Among the northeastern tribes of Asia fungi are largely used as food. One species, when pounded, forms their snuff, while another, the *Fly Agaric*, which is utilized in Europe as a fly-killer, and is regarded as one of the most poisonous forms, is used by them as a substitute for ardent spirits, one large specimen being sufficient "to produce a pleasant intoxication for a whole day." In many parts of Europe fungi are a favorite food, being eaten fresh, and also preserved in vinegar for winter use. For pickling purposes, all kinds, it is said, are gathered, the vinegar being supposed to neutralize the alkaline poison of the noxious species. The common mushroom, the morel, and the truffle are, however, the favorite edible fungi. In Italy the value of the mushroom as an article of diet has long been understood and appreciated. Pliny, Galen, and Dioscorides mention various esculent species, notably varieties of the truffle, the boletus and the puffball. At Rome it has been the custom of the Government to appoint inspectors to examine all the mushrooms brought into market and to reject such as are poisonous or worthless, which are thrown into the Tiber. It was forbidden also to hawk mushrooms about the streets, and all were required to be sent to the central depot for inspection.

The yearly average of the taxed mushrooms sold (all over 10 pounds being taxed) in the city of Rome alone, for the past decade, has been estimated at between 60,000 and 80,000 pounds weight. Large quantities of mushrooms are consumed in Germany, Hungary, Russia, and Austria, and in the latter country a list is published, by authority, of those mushrooms which upon official examination may be sold. Darwin speaks of Terra del Fuego as the only country where cryptogamic

plants form a staple article of food. A bright yellow fungus allied to *Bulgarin* forms, with shellfish, the staple food of the Fuegians. In England the common meadow mushroom *Agaricus campestris* is quite well known and used to a considerable extent among the people, but there is not that general knowledge of and use of other species which obtains on the continent. Much has been done of late years by the Rev. M. J. Berkeley, Dr. Curtis, Dr. C. D. Badham, Dr. M. C. Cooke, Worthington G. Smith, Prof. Charles Peck, and others to disseminate general knowledge on this subject. That America is rich in the quantity and variety of her esculent fungi is readily seen by the fact that one hundred and eleven species of edible fungi have been described by the Rev. Dr. Curtis, State botanist of North Carolina, as indigenous to that State alone. Late investigations show that nearly all the species common to the countries of Continental Europe are found in different localities in the United States. Dr. J. J. Brown, of Sheboygan, Wis., writes that edible mushrooms are found in his neighborhood in great abundance.

In preparing this paper for publication I have made selections from such of the species of edible mushrooms as have marked peculiarities of structure, habits, taste, odor, color, juice, and change of color of juice on exposure to the atmosphere.

TWELVE EDIBLE SPECIES.

Lactarius deliciosus Fr. *Orange Milk Mushroom.*

Fig. 1.

This mushroom (*Lactarius deliciosus*) is highly recommended by different authors. It belongs to the Lactars or milk-bearing group. As a group the milk-bearing mushrooms are generally viewed with suspicion, but the species "deliciosus" receives general commendation as an esculent. It is easily distinguished from any other of the group by the orange or red color of the milk which exudes from it when cut or broken. The flesh changes on exposure to the atmosphere, as does the milk also, and becomes a dull green color. This mushroom has a firm, juicy flesh; its richly colored orange top is commonly, but not invariably, marked with zones of a deeper color. The stem is often spotted red; the gills or lamellæ are the same color as the cap or pileus. It is found in plantations of fir and pine and in swampy woods. A poisonous mushroom of this subgenus similar in shape and size can be readily distinguished from it by its white milk, which does not change. The flavor of *Lactarius deliciosus* when cooked is said to resemble that of "kidney stew."

Method of cooking.—The rich gravy it produces is its chief characteristic, hence it commends itself for sauces or as an ingredient in soups. It requires delicate cooking, as it becomes tough if kept over the fire until its juice has evaporated. Baking is perhaps the best method of preparing this mushroom for the table.

Cantharellus cibarius Fr. *Chanterelle.*

Fig. 2.

Wherever found, this species (*Cantharellus cibarius*) grows in great abundance. It is very popular in Europe, where in some localities the inhabitants make it their principal food. It is easily recognized by its rich color and the peculiar form of its gills. It is generally found in light woods and high situations. The pileus is lobed and irregular in shape. When young it is dome-like, the margin rolled in; as it approaches maturity the margin expands, forming an irregular wavy line, and the center of the pileus becomes depressed. The color is orange or deep yellow, somewhat resembling that of the yolk of an egg. The stem is tough, white, and solid, becoming hollow in maturity. The gills, which appear like short, branching veins, are thick and wide apart, and are of the same color as the pileus. The texture is smooth, the flesh white and dense, and has a pleasant odor. Vittadini compares it to that of plums. It is somewhat dry and tough in character, and therefore requires slow and protracted stewing, with plenty of liquid. In selecting for culinary purposes, crisp and heavy ones should be chosen in preference to light and soft ones, as being less likely to become leathery in cooking. Some recommend soaking them in milk over night to render them tender.

Mrs. Hussey gives the following receipt:

Cut the mushrooms across and remove the stems; put them into a closely covered saucepan, with a little fresh butter, and sweat them until tender at the lowest possible temperature. A great heat always destroys the flavor.

A deleterious species (*Cantharellus "aurantiacus"*), often found in rank grass or decaying herbage, is of the same color, and by a careless observer might be taken for the wholesome species. A little care and attention to detail, however, will enable one to distinguish one from the other. In the *Cantharellus aurantiacus* the pileus is covered with down and the veins or gills are crowded, thin, and of a much deeper color than the pileus.

Marasmius oreades Bolt. *Fairy Ring Champignon.*

Fig. 3.

This mushroom (*Marasmius oreades*) is represented by all mycologists as one of the most highly flavored. It grows in rings in short pastures, on downs, and by road sides, but never in woods. It is very well marked, somewhat tough, the solid stem particularly so. In color it is a bright buff. The gills are wide apart and are of a cream color. When dried it can be kept for years without losing its flavor. "It is much used in the French *à la mode* beef shops in London, with the view of flavoring that dish." Dr. Badham, Rev. M. J. Berkeley, and Mr. Worthington G. Smith, of England, highly recommend the *Fairy Ring Champignon*, and it is said by experts in the culinary art that, when

boiled with butter, it has an exquisitely rich and delicious flavor. Mr. Berkeley says it is so common in some districts in England that bushels may be gathered in a day.

Another species of this genus (*M. peronatus*, or Hairy Foot), found growing in woods, on dead leaves, is to be avoided. The gills of this species are darker in color and narrower. It has a hairy down at the base of the stem by which it may also be distinguished.

Hydnum repandum L. *Hedgehog or Spine Mushroom.*

Fig. 4.

The genus *Hydnum* being so well defined, having spines instead of gills or pores, is easily distinguised from all others.

The pileus of the species *repandum* is irregular in shape, depressed in the center, fleshy, and of a pale cinnamon or yellowish color.

Flesh firm and white, turning slightly brown when bruised. The spines are awl-shaped, of various sizes, crowded and running down; paler in color than the pileus. Stem solid, at first white, and then tawny cream color; spores round and white. There are no poisonous species in this genus, although some are too tough to be considered edible.

The species *repandum* is the most desirable of the genus *Hydnum*. M. Roques, an eminent French mycologist, says:

> The general use of this fungus throughout France, Italy, and Germany leaves no room for doubt as to its good qualities.

It is common in oak and pine woods in England. Mrs. Hussey recommends stewing this mushroom in brown or white sauce.

> Cook slowly and for a long time and keep well supplied with liquid, it being naturally deficient in moisture.

Its dry nature makes it easy to preserve, and it may be kept for a great length of time.

Agaricus campestris L. *Meadow Mushroom.*

Fig. 5.

To distinguish this species (*campestris*, or meadow mushroom) requires very little discrimination. The cap or pileus is fleshy, white, or tawny, sometimes brownish. When it is in its best condition for use the gills are a beautiful pink in color, ultimately becoming a deep brown, which reaches nearly to the stem, which carries a well-marked white woolly ring or volva. The cap is usually more or less adorned with minute silky fibrils. The margin generally extends a little beyond the outer extremity of the gills. It has an enticing fragrance, and the white flesh is sometimes inclined to change to pink when broken. It grows in open grassy places in fields and rich pastures, but never in thick woods.

It may be prepared for the table by stewing with butter, spice, parsley, sweet herbs, salt and pepper, and a little pure lemon juice. It makes a fine catsup, and cut up in small pieces and stewed with butter makes an agreeable adjunct to a steak or mutton chop. The catsup may be used to give flavor to soup or beef tea.

This mushroom should be eaten fresh and served hot.

Dr. Badham says:

> The mushroom having the same proximate principles as meat, requires, like meat, to be cooked.

Mr. Worthington G. Smith says:

> The *Agaricus arvensis* (horse mushroom) is a species very nearly allied to the meadow mushroom and frequently grows with it, but it is coarser and has not the same delicious flavor. It is usually much larger, often attaining enormous dimensions; it turns a brownish yellow as soon as broken or bruised. The top in good specimens is smooth and snowy white; the gills are not the pure pink of the meadow mushroom, but a dirty brownish white, ultimately turning brown. It has a big, ragged, floccose ring, and the pithy stem is inclined to be hollow.

Coprinus comatus Fr. *Maned Agaric.*

Fig. 6.

The maned agaric (*Coprinus comatus*) is considered one of the most delicious of all the mushroom tribe when young. The cap is first cylindrical, then bell-shaped, then expanded, more or less scaly, and split longitudinally. The flesh is thick in the center and very thin at the margin. The gills are free, and at first white or pinkish, then black, soon melting into an inky fluid, the color of which is due to the presence of black spores. The ring on the stem is moveable, then disappears. The stem is white and hollow. This mushroom grows in waste and grassy places, lawns, and meadows. Only young specimens are desirable for esculent purposes. Mr. Worthington G. Smith, as the result of considerable experience, observes:

> It must be noted, however, that when too young this agaric is rather deficient in flavor and its fibers tenacious. Its flavor is most rich and its texture most delicate when the gills show the pink color with sepia margins.

It decays rapidly and should be cooked immediately after gathering. A very simple method is to broil and serve on toast.

Morchella esculenta P.

Fig. 7.

This mushroom is known under a variety of names—*Phallus esculentus*, *Helvella esculenta*, etc. The genus *Morchella* has but few species, and most authors agree that all are edible. Berkeley considers the *Morchella semilibera* as doubtful. The head of the morel is deeply pitted, hollow, thin, and firm, and when fully grown is several inches in diameter. The morel is found in April and May, in grassy places, on the

border of fields and the raised banks of streams, sometimes in fir or chestnut forests and in hilly countries. It prefers a calcareous ground and flourishes on wood ashes.

In Germany, France, and England it is well known and highly esteemed. In the United States it is little known, although it grows in several of the States in great abundance. I have had specimens of it from Missouri, Wisconsin, and Maryland. Curtis speaks of finding it in North Carolina, but not in quantity. It is identical with the European morel. In Yorkshire, England, the women who gather cowslips for wine-brewing bring to market a few morels in the corners of their baskets and ask an extra shilling for them. The dried morel is used in parts of England to give a flavor to certain kinds of sauce. Large quantities of this fungus, in a prepared condition, are imported into England from the continent.

The following receipt will illustrate one of the methods of cooking this excellent mushroom:

Having washed and cleaned from them the earth which is apt to collect in the hollows of the plants, dry them thoroughly in a napkin, and put in a saucepan with pepper and salt and parsley, adding, or not, a piece of ham; stew for an hour, pouring in occasionally a little broth to prevent burning. When sufficiently done, bind with the yolks of two or three eggs and serve on buttered toast.

Clavaria cinerea Bull.

Fig. 8.

Of this species (*Cinerea*) M. C. Cooke observes:

It has a short, thick stem, is very much branched and irregular, and becomes ultimately of a cinereous hue. The substance is brittle, and not tough as in some species. In France it is known under various names, as *Pied de coq, Gallinole*, etc., and in Italy as *Ditolarossa;* in both of those countries it is eaten.

It is quite plentiful in this country. I have had some fine specimens from the White Mountains. All the white spored *Clavarias* are wholesome.

Clavaria rugosa Bull.

Fig. 9.

This species (*Clavaria rugosa*) is not generally found in sufficient quantities to make it of much value as an esculent, but it is wholesome, and can be cooked with other varieties of the genus. It is irregular in shape, white, and sometimes delicately tinted with gray. Before cooking, the plants should be sweated with butter over a slow fire and the liquor thrown away. They may then be wrapped in slices of bacon and stewed for an hour in a little sauce or gravy, seasoned with salt, pepper, and parsley, then served with white sauce.

Boletus edulis Bull. *Edible Pore Mushroom.*

Fig. 10.

Dr. Badham says:

The word *Boletus*, which has at different times and under different mycologists been made to represent in turn many different funguses, is now restricted to such as have a soft flesh, vertical tubes underneath, round or angular, slightly connected together and with the substance of the cap, open below and lined by the sporiferous membrane; the cap horizontal, very fleshy; the stalk generally reticulated.

In this group it has been said that there are but few edible species and some that are very deleterious. The flesh of the poisonous species, it has been said, also invariably turns blue when bruised or broken, but this test, I think, can not be relied upon. "The *Boletus edulis*," says Badham, "can not be mistaken for any other *Boletus*, because it alone presents the following characters united, viz: A cap, the surface of which is smooth; tubes, the color of which varies with each period of its growth; beautiful and singular reticulation of the stalk, especially towards the upper portion, and *a flesh which is white and unchanging.*

The cap is brown. At first the tubes are white, then pale yellow, and when mature, a dull greenish yellow. For table use the specimens should be gathered when the tubes are pale yellow; it is then most tender. The stem is solid and quite thick, at first white, but turning to a light brown in maturity, displaying near the top a network of pinkish veins. It is sold in quantities in Italy. It is also quite popular in Hungary, Germany, and Russia, and other European countries. It grows most abundantly in the autumn, although often found in spring and summer. It is found chiefly in the woods, more especially of pine, oak, and chestnut. The following receipt for cooking the *Boletus* is given by Persoon:

It may be cooked in white sauce with or without chicken in fricassee, broiled or baked with butter, salad oil, pepper, salt, chopped herbs, and bread crumbs, to which add some ham or a mince of anchovy.

Its flesh is tender and juicy and it requires less cooking than some of the tougher mushrooms.

Lycoperdon giganteum Batsch. *Puffball.*

Fig. 11.

The giant puffball (*Lycoperdon giganteum*), so generally neglected, is one of the most valuable of the edible mushrooms. It is readily distinguished from other puffballs and allied fungi by its large size, it being from 10 to 20 inches in diameter, and by its form is easily separated from all other mushrooms. It is somewhat globose in form, whitish, or pale yellowish brown in color, filled with a soft white flesh when immature, which changes to an elastic, yellowish brown, cottony, but dusty mass of filaments and spores when mature.

In this state the peel or rind breaks up and gradually falls away in fragments. I have made full inquiry regarding it among mycologists and have not found a dissenting voice as to its value as an esculent. They all agree as to its edibility and tender character. All the species are edible, but the smooth-skinned varieties are more palatable than the rough-skinned.

Vittadini, an Italian mycologist, says:

When the giant puffball is conveniently situated you should only take one slice at a time, cutting it horizontally, and using great care not to disturb its growth, to prevent decay, and thus one may have a fritter every day for a week.

Dr. M. C. Cooke, the eminent London mycologist, writes with enthusiasm of the merits of the giant puffball as an esculent, deeming it a delightful breakfast relish.

Mrs. Hussey, of England, gives the following receipt for "puff-ball" omelet:

First remove the outer skin; cut in slices half an inch thick; have ready some chopped herbs, peppers, and salt; dip the slices in the yolk of an egg and sprinkle the herbs upon them; fry in fresh butter and eat immediately.

The puff-balls must be gathered young. If the substance within is white and pulpy it is in good condition for dressing, but if marked with yellow stains it should be rejected.

The puff-ball is found growing in many parts of the United States and a few fine specimens have been forwarded to this Department for inspection. I have myself tested a fine specimen of the giant puff-ball found in the Department Grounds, finding it delicious eating when fried in egg batter.

I am informed that the giant puffball (*Lycoperdon giganteum*) is found in great abundance growing on the Genesee Flats, Livingstone County, N. Y.

J. M. Dodge, Glencoe, Nebr., writes to the U. S. Department of Agriculture, April 9, 1878:

I am much interested in the article "Edible Fungi," published in the Department Report for 1876. We have here a species of puffball which when young has firm, white flesh, and I think would be good to eat. It sometimes grows to a large size. It is quite abundant on the prairie in summer, and if edible would offer a large amount of food.

A correspondent of the Argus, Clayton, Mo., October 14, 1887, writes:

The United States Agricultural Report of 1885 gives clear descriptions and beautiful drawings of twelve typical edible fungi. Of these, No. 7, *the morel*, page 105, in the spring, we use large quantities. Since the late rains we have had twice a day a full supply of No. 6, *Maned agaric*, as a stew, and No. 11, "puffball," fried as a fritter. It is a misfortune that so little is known of this valuable class of products that are given by bountiful nature by the ton without any labor whatever. The nation is deeply indebted to Dr. Taylor, Microscopist, U. S. Department of Agriculture, for these clear details and most reliable, lifelike drawings, and we hope they will be issued as a separate bulletin and sent out among the people by the million. Give us more light on those subjects.

Fistulina hepatica Fr. *Liver Fungus.*

Fig. 12.

This fungus (*Fistulina hepatica*) is frequently found on old oaks, chestnuts, and ash. It develops from the rotten bark. It appears first as a rosy pimple at any time during the summer season. In a very short time it becomes tongue-shaped and assumes the color of a beet-root. In a few days it changes form again, becoming broad in comparison to its length and changing color to a deep blood-red. Its lower surface is often paler than its upper, it being tinged with yellow and pink hues. It requires about two weeks to attain its highest development, after which it gradually decays.

It varies in size from a few inches to several feet in circumference. Rev. M. J. Berkeley mentions one which weighed 30 pounds. It has been styled, the "*poor man's fungus*," and in flavor resembles meat more than any other.

When young and tender it can be sliced and broiled or minced and stewed, making a delicious dish. When old, the stock is rather tough for good eating, but the gravy taken from it is equal to that of the best beefsteak. The following receipt for cooking this fungus is recommended:

Slice and macerate it, add pepper and salt, a little lemon, and minced eschalots, a species of onion and garlic; then strain and boil the liquid, which makes most excellent beef gravy.

This fungus is esteemed in Europe, where it is eaten prepared in a variety of ways. Where it grows at all, it grows abundantly. I have found some fine specimens in the District of Columbia.

METHODS OF CULTIVATION.

Many methods of cultivating the common meadow mushroom have been presented by different growers, but all agree as to the value of the general methods in practice. Nearly every farm and nursery affords the conditions necessary to cultivate the ordinary field mushrooms, such as sheltered sheds, stables, and small hot-beds for winter cultivation, and melon patches, cucumber pits, etc., for summer culture.

Mushroom spawn in "bricks" can be easily obtained from the seedsmen. Natural or virgin spawn, which is considered by many experienced growers as preferable to the artificial, can be obtained in most places where horses are kept. It is found in half-decomposed manure heaps, generally where horse droppings have accumulated under cover. It is readily distinguished by its white filamentous character, and by its mushroom odor. When dried it can be kept for years.

Mushroom beds are easily formed on the floor of sheds, by carrying in the fresh stable dung, adding to it about one-fourth of good loam, mixing both together, pressing firmly down, and letting the mass remain about two weeks untouched. By this time the temperature will

be on the decline, and when it falls to 90° F., break the bricks of spawn into pieces 2 inches square, and plant 12 inches apart, 3 inches below the surface. Then cover over to the depth of 3 inches with good garden soil and press down firmly.

It is recommended that mushroom beds should not be finally earthed until the spawn is seen beginning to spread its white filaments through the mass; and should it fail to do this in eight or ten days after spawning, the conditions being favorable, it is better to insert fresh spawn or to remake the bed, adding fresh materials if it be found to fail from being too cold.

It is advisable not to put the spawn at any uniform depth, but so that while one piece of it may be at a depth of 6 inches, or nearly so, others may touch the surface. This allows the spawn to vegetate at a depth and temperature most congenial to it. Mushrooms may be cultivated in warm cellars, in boxes about 4 feet square by 18 inches in depth, for family use.

APPENDIX.

DIRECTIONS FOR THE PREPARATION AND SPAWNING OF MUSHROOM BEDS.

The following practical directions for the preparation and spawning of mushroom beds have been transcribed from Mr. William Falconer's valuable treatise, "Mushrooms, and How to Grow Them," and are appended in the belief that they will form a valuable supplement to the preceding pages:

PREPARING THE BEDS.

When enough manure has accumulated for a bed, prepare it in the following way: Turn it over, shaking it up loosely and mixing it all well together. Throw aside the dry strawy part, also any white "burnt" manure that may be in it, and all extraneous matter, as sticks, stones, old tins, bones, leather straps, rags, scraps of iron, or such other trash as we usually find in manure heaps, but do not throw out any of the wet straw; indeed we should aim to retain all the straw that has been well wetted in the stable. If the manure is too dry, do not hesitate to sprinkle it freely with water, and it will take a good deal of water to well moisten a heap of dry manure. Then throw it into a compact oblong pile about 3 or 4 feet high and tread it down a little. This is to prevent hasty and violent heating and "burning," for firmly packed manure does not heat up so readily or whiten so quickly as does a pile loosely thrown together. Leave it undisturbed until fermentation has started briskly, which, in early fall, may be in two or three days, or in winter, in six to ten days; then turn it over again, shaking it up thoroughly and loosely and keeping what was outside before inside now, and what was inside before toward the outside now; and if there are any unduly dry parts moisten them as you go along. Trim up the heap into the same shape as before and again tread it down firmly.

This compacting of the pile at every turning reduces the number of required turnings. When hot manure is turned and thrown loosely into a pile it regains its great heat so rapidly that it will need turning again within twenty-four hours in order to save it from burning, and all practical men know that at every turning ammonia is wasted, the most potent food of the mushroom. We should therefore endeavor to

get along with as few turnings as possible; at the same time never allow any part of the manure to burn, even if we have to turn the heap every day. These turnings should be continued until the manure has lost its tendency to heat violently, and its hot rank smell is gone—usually in about three weeks' time. If the manure, or any part of it, is too dry at the turning, the dry part should be sprinkled with water and kept in the middle of the heap. Plain water is generally used for moistening the manure, but I sometimes use liquid from the stable tanks, which not only answers the purpose of wetting the dry materials, but it is also a powerful stimulant and welcome addition to the manure. But the greatest vigilance should be observed to guard against overmoistening the manure; far better fail on the side of dryness than on that of wetness.

If the manure is too wet to begin with it should be spread out thinly and loosely and exposed to sun and wind, if practicable, to dry. Drying by exposure in this way is not as enervating as "burning" in a hot pile; and better have recourse to any method of drying the manure than use it wet. If, on account of the weather or lack of convenience for drying, the manure can not be dried enough, add dry loam, dry sand, dry half-rotted leaves, dry peat moss, dry chaff, or dry finely-cut hay or straw, and mix together.

The proper condition of the manure as regards dryness or moistness can be readily known by handling it. Take a handful of the manure and squeeze it tight; it should be unctous enough to hold together in a lump and so dry that you can not squeeze a drop of water out of it.

Some private gardeners in England lay particular stress upon collecting the fresh droppings at the stable every day and spreading them out upon a shed or barn floor to dry, and in this way keeping them dry and from heating until enough has accumulated for a bed, when the bed is made up entirely of this material or of part of this and part of loam. But market gardeners, the ones whose bread and butter depend upon the crops they raise, never practice this method, and that patriarch in the business, Richard Gilbert, denounces the practice unstintedly. Different growers have different ideas of preparing manure for mushroom beds, but the aim of all is to get it into the best possible condition with the least labor and expense, and to guard against depriving it of any more ammonia than can be helped.

SPAWNING THE BEDS.

After the mushroom bed is made up it should, within a few days, warm to a temperature of 110° to 120° F. Carefully observe this, and never spawn a bed when the heat is rising or when it is warmer than 100°, but always when it is on the decline and under 90°. In this there is perfect safety. Have a ground thermometer and keep it plunged into the bed; by pulling it out and looking at it one can easily know exactly

the temperature of the bed. Have a few straight smooth stakes, like short walking canes, and stick the end of these into the bed, 12 to 20 feet apart; by pulling them out and feeling them with the hand one can tell pretty closely the temperature of the bed.

All practical mushroom-growers know that if the temperature of a 12-inch thick bed at 7 inches from the surface is 100° that within an inch of the surface of the bed will only be abont 95° indoors and 85° to 90° out of doors. Also, that when the heat of the manure is on the decline it falls rapidly 5, often 10, degrees a day till it reaches aboul 75°, and between that and 65° it may rest for weeks.

Some years ago I gave considerable attention to this matter of spawning beds at different temperatures. Spawn planted as soon as the bed was made (five days after spawning, the heat in interior of bed ran up to 123°) yielded no mushrooms, the mycelium being killed. The same was the case in all beds where the spawn had been planted before the heat in the beds had attained its maximum (120° or over). Where the heat in the middle of the bed never reached 115°, the spawn put in when the bed was made and molded over the same day yielded a small crop of mushrooms. A bed in which the heat was declining was spawned at 110°; this bore a very good crop, and at 100° and under to 65°, good crops in every case were secured with several days' delay in bearing in the case of the lowest temperatures. But, notwithstanding these facts, my advice to all beginners in mushroom-growing is, wait until the heat of the bed is on the decline and has fallen to at least 90° before inserting the spawn.

Writing to me about spawning his bed, Mr. Withington, of New Jersey, says: "I believe a bed spawned at 60° to 70° and kept at 55° after the mushrooms appear will give better results than one spawned at a higher temperature, say 90°."

Here is the oddest thing about Mr. J. G. Gardner's method of mushroom-growing. He does not give the manure any preparatory treatment for the beds. He hauls it from the cars to the cellar, at once spreads it upon the floor, and packs it solid into a bed. For example, on one occasion the manure arrived at Jobstown, July 8. It was hauled home and the bed made up the same day, and the first mushrooms were gathered from this bed the second week in September, just two months from the time the manure left the New York or Jersey City stables. The bed was 15 inches thick. In making it the manure was first shaken up loosely to admit of its being more evenly spread than if pitched out in heavy forkfuls, and it was then tramped down firmly with the feet. The bed was then marked off into halves. On one-half (No. 1) a layer of a little over 3 inches of loam was at once placed over the manure. On the other half (No. 2) no loam was used at this time, but the manure on the surface of the bed—about 3 inches deep—was forked over loosely. Twelve days after having been put in the temperature of the bed No.

2 (3 inches deep) was 90° and then it was spawned. On the next day the soil from bed No. 1, spawned four days earlier, was thrown upon bed No. 2, and then part of the soil that was thrown on No. 1 was thrown back again on No. 2, so that now a coating of loam an inch and a half deep covered the whole surface of the bed. When finished the surface was tamped gently with a tamper with a face of pine plank 16 inches long by 12 inches wide. Mr. Gardner does not believe in the alleged advantages of a hard-packed surface on the mushroom bed, but is inclined to favor a moderately firm one.

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